FRD Activities Report
June 2004

Research Program

New York City Urban Dispersion Study

Tom Watson represented ARL/FRD at the planning meeting for the New York City Urban Dispersion Study on June 28 and 29, 2004. The Department of Homeland Security (DHS) has requested the assistance of the FRD in planning and conducting the study. The DHS program manager emphasized that the study was a world class science program directed towards model improvement, and that DHS wants to develop a meso-scale prognostic model that can provide 30-60 minute projections that will enable emergency response managers to make decisions such as whether to direct people to take shelter or evacuate an area. The Defense Threat Reduction Agency (DTRA) is sponsoring an upcoming small-scale perfluorocarbon dispersion study in the Madison Square Garden area to be conducted by Brookhaven National Laboratory in November-December 2004. Both DHS and DTRA want to apply the data from these studies to improve and generalize models so that they can be applied to cities throughout the world. Both emphasized that characterizing vertical dispersion is important and that tracer concentration data with high time resolution is critical. Jerry Alwine, Batelle PNL, is the program manager. He presented purpose, goals, and organization of the program. The purpose is to improve urban dispersion models with the additional benefit of enhancing the NYC Office of Emergency (OEM) ability to respond to airborne releases of harmful material. The program is organized around five tasks, with PIs for each task. These are:

- Developing and implementing a permanent NYC meteorological network.
- Developing and implementing a permanent radiation monitoring network.
- Field Programs: Designing and implementing field programs consisting of tracer studies, including SF_6 and perfluorocarbons.
- Applying urban models to assist in the design of the field programs and to help in understanding the data from field programs.
- Getting the results of the program into the operations of the NYC EOM.

The field programs will investigate the seasonal variation of dispersion in the NYC region with four different study periods planned in all four quarter of the year, beginning in March 2005. models to gain insight to help design field experiments and to help with the interpretation of the tracer data.

The results of the Midtown Manhattan fugitive SF_6 survey that was conducted in January 2004 by Kirk Clawson were published in June and presented to the NYC planning Group.. Conclusions of this study were:

- Electrical substations in the city release SF_6 that impact the target test area around Times Square.
- There were no significant SF_6 sources other than the substations.
- The impacts of the East 13th Street and Central Park substations would be negligible under most wind conditions.
- Two types of dispersion tests can be conducted using SF_6.
    - The SF_6 emissions of West 49th Street substation can be used as a source when winds are from the west and northwest.
    - Under other wind conditions SF_6 can be intentionally released.

Based on these results, the area of the city where the field program is focused may be changed because of concerns about fugitive sources. FRD emphasized that we need to define the spatial domain of the field programs soon, since changing the test area will require another survey of fugitive sources. We also need to work with the modelers to make sure that we provide data with spatial and temporal resolution and tracer concentration values that can be compared with the model output. (Tom Watson, 208 526-9397, and Kirk Clawson)

Smart Balloon

The Smart Balloon and electronic payload was tested on the ground over the course of several weeks to ensure the proper operation of the balloon controls and reliable satellite communication. The Smart Balloon with the newly improved electronic payload was launched in the early afternoon of June 19th and tracked for about four and a half hours. Communications and balloon controls worked flawlessly. The balloon cut-down worked as planned when high winds associated with a local afternoon storm started blowing the balloon into the mountains east of Idaho Falls. The balloon was recovered from where its landing point about 20 meters from an access road. There was no damage to the balloon or the transponder payload. The balloon is ready for deployment to the AIRMAP/Targeted Winds Project in July. (Randy Johnson, 208 526-2129 and Shane Beard)

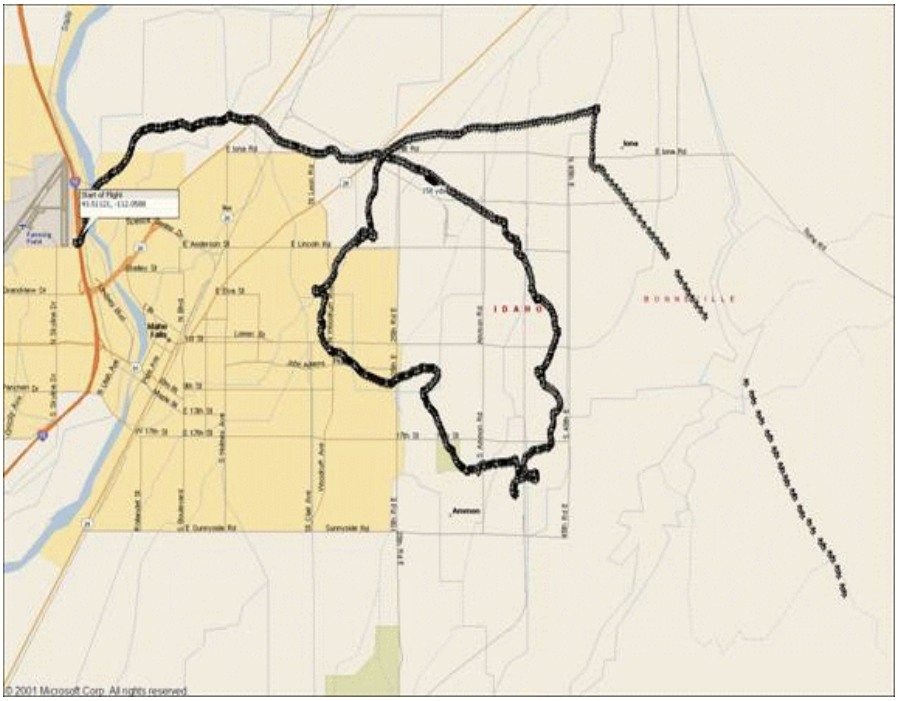

Figure 1. Trajectory of the Smart Balloon test launch from the FRD office on June 19.

Pentagon Shield

The initial analysis of the data from the continuous SF_6 analyzers has been completed. Work is now focusing on resolving a number of problems with the data files. These include incorrect times, data sets split into multiple files, incorrect limit of detection calculations, etc. The problems should be resolved within a couple weeks and work will begin on attempting to estimate baseline from zero-air calibrations during extended periods of high concentrations of SF_6. (Roger Carter, 208 526-2745)

The analysis of the programmable integrating gas samplers (PIGS) was finished this month, including all re-analysis of samples that did not meet quality control acceptance limits. All the QC average results were calculated and graphed to look for trends. These results were compared to the QC target limits that we have determined for this project. All the time history plots have been printed and have been reviewed. Efforts to track the reasons for bag or cartridge results that do not appear to be valid are ongoing. Multiple download problems have resulted in several pages of changes to be made to the final data output.

The method limit of detection (MLOD) and the method limit of quantitation (MLOQ) were also calculated. The final MLOD and MLOQ have not been chosen, however, due to a positive bias on the low end up until about 40 pptv. We are attempting to determine what caused this bias in the controls, and how it correlates to the sample results. In choosing the MLOD and MLOQ, we consider many different indicators including the recovery percentages, signal to noise ratios, and the percent relative standard deviation (RSD). For this project the recoveries on the low end (<44.9 pptv) are greater than acceptable. This is an indication of some kind of low level contamination. The lab controls do not show this bias, and this problem did not occur with the Joint Urban 2003 study. (Debbie Lacroix, 526-9997)

CBLAST-High

Test and calibration flights were conducted with the NOAA P-3 on the 28th and 30th of June. One five-hour mission was flown on each of the two days. The main goals of the flights were to (1) provide calibration data for the BAT and verify proper operation of the probe, and (2) to test new flight patterns for the upcoming hurricane season. For the both objectives, the test/cal flights were a success. Two of the sensors on the BAT were not operating properly during the first flight. On the down day between flights, it was determined that there were several suspect electrical connections on the new sensor board. These connections were fixed and the subsequent flight proceeded without any problems.

In an attempt to maximize the utility of flight time spent below 1200 meters for the upcoming hurricane season, new flight strategies were developed and tested. Fewer flight levels will be used, but there will be longer runs at a given flight level. The new patterns were tested and deemed successful.

An abstract entitled “Direct Measurements of Turbulent Fluxes in Hurricanes from an Instrumented Aircraft” was accepted for presentation at the 4th annual meeting of the European Meteorology Society to be held in Nice, France in October 2004. (Jeff.French, 208 526-0566)

ET Probe

The modified ““big port”” ET probe has now been tested several times in the rain. In each case, it has performed well. The Gill sonic anemometer that is operated with the ET probe in these tests generally has severe problems with rain spikes. In contrast, the ET probe has continued to operate without any noticeable spikes. The only sensors that have shown some rain effects are the temperature sensors in the “mushroom” housing on top of the probe. In some cases, water appears to have coated these sensors. This is difficult to eliminate without totally redesigning the mushroom housing. Based on the success of the design, a second ET probe is being modified. The plan is to deploy two of these “big-port” ET probes during the upcoming hurricane season. ATDD is working on a separate design that uses an air pump to flush the ports. If this design works out, total of three ET probes may wind up being deployed this season. (Richard.Eckman, 208 526-2740 and Tom Strong)

Proteus Aircraft

The manufacture of the BAT cone and hemisphere were completed this month. The electronics were tested and calibrated. The final assembly will be completed in July in anticipation of an installation on the Proteus aircraft sometime in August. (Jeff French@noaa.gov)

Cooperative Research with INEL

Semi-Annual Preventative Maintenance and Calibration

The semi-annual maintenance and calibration of all meteorological sensors in the INEEL Mesonet was begun in June. During the inspection, all of the meteorological instrumentation on the 35 towers were examined to verify proper operation and calibration. Necessary repairs or replacements were made to ensure continued operation. All instruments were calibrated to NIST-traceable standards to verify that the data being collected is accurate and complete. (Tom Strong, 208 526-5434)

Emergency Operations Center (EOC)

There were several exercises at the EOC during June. The Annual Training Exercise took place on June 16. The scenario involved a traffic accident between two trucks that resulted in a wildfire. Meteorological support was provided by Rick Eckman and Debbie Lacroix. They provided current weather conditions and forecasts with emphasis on the shifting wind conditions and plume projections using MDIFF.

On June 24 the EOC was activated for a hydrogen fluoride release at the INTEC facililty. A small leak was detected in a gas cask which was quickly stopped. Neil Hukari provided weather conditions and forecasts as well as the results from model runs.

The last EOC exercise was the Quarterly Assessment Specialist Drill on June 29. This was a training exercise for the people manning the EOC Planning Room. Neil Hukari provided information on current weather conditions for the area involved and forecasts. Models were run during the exercise.

INEEL Support

As a result of a request from the State of Idaho's INEEL Oversite Program, FRD is looking to various methods for estimating the depth of the planetary boundary layer (PBL). This is a standard input variable required by most dispersion models. A climatological database of PBL depths is available for INEEL based on soundings taken many years ago, but FRD currently has no standard procedures for estimating this depth. Three approaches are being considered. One is to manually estimate the depth using the data from the radar-profiler system operated at the site. This system provides both wind and temperature profiles, and would be useful for locating the capping inversion at the top of the PBL in convective conditions. A second approach is to use data from the surface-flux tower operated at INEEL by FRD. This tower provides both energy and momentum fluxes. Various algorithms have been proposed in the literature for estimating PBL depth using such surface data. This approach has the advantage of being more automated, and may be particularly suited for stable conditions. A third approach is to use the forecast PBL depths generated by the MM5 model runs at FRD. This would be most useful when one is trying to project a contaminant release several hours out into the future. (Richard.Eckman, 208 526-2740)

Other Activities

Papers

An abstract entitled "Direct Measurements of Turbulent Fluxes in Hurricanes from an Instrumented Aircraft" was accepted for presentation at the 4th annual meeting of the European Meteorology Society to be held in Nice, France, October 2004. (Jeff.French, 208 526-0566)

An extended abstract entitled, "Joint Urban 2003 vertical SF_6 real-time analyzer and time-integrated sampler data characteristics," was submitted to the American Meteorological Society for presentation at the 5th Symposium on the Urban Environment to be held in Vancouver, Canada, in August. (Kirk Clawson, 208-526-2742)

Safety

Work continues on the removal of hazardous materials, including the smoke grenades, mercury barometer and other hazardous chemicals. Mark George is coordinating with the contractor

(Tetra-Tech) for the removal of these items before the end of July. (Debbie Lacroix**,** 208 526-9997**)**

Travel

Jeff French to Tampa, Florida, June 27 through July 1, for calibration test flights for the P-3 aircraft to be used in CBLAST hurricane research.

Tom Watson to New York City, June 28 through July 1, to attend the New York City Urban Dispersion Program First Scientific Meeting.

Randy Johnson and Shane Beard to Long Island, New York, June 30 through August 8, to participate in the Targeted Winds Project.